

U.S.S.N. 10,804,449

Claim Amendments

Please amend claims 1, 3, 5, 6, 8, 9, 11-14, 15, 16, 19-22 as follows:

Please cancel claims 2, 4, 10, 17, and 18 as follows:

Please add new claims 23-27 as follows:

1. (currently amended) A method for forming a patterned silicon-containing layer structure to avoid notching along sidewalls of said structure, comprising:

providing a substrate;

providing a polysilicon layer on said substrate;

providing a hard mask layer on said polysilicon layer;

patterning and etching said hard mask layer; and

partially etching through a first thickness of said polysilicon layer according to said hard mask layer without exposing the underlying substrate using a fluorine([-]) containing etchant gas based etching chemistry; and,

then etching through a remaining thickness of said silicon layer to expose said underlying substrate according to said hard mask layer using an etchant gas devoid of fluorine.

2. cancelled

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3. (currently amended) The method of claim 1 wherein said step of
partially etching said polysilicon layer comprises etching said
polysilicon layer according to the following process parameters:
a chamber pressure of from about 5 mTorr to about 80 mTorr; a
source radio frequency power of from about 100 watts to about
1500 watts at a source radio frequency of 13.56 MHz; and a bias
power of from about 100 watts to about 1500 watts.

4. cancelled

5. (currently amended) The method of claim 1 wherein said
polysilicon layer comprises pre-doped polysilicon.

6. (currently amended) The method of claim 1 wherein said
polysilicon layer comprises amorphous silicon.

7. (original) The method of claim 1 wherein said hard mask layer
is a material selected from the group consisting of silicon
oxide, silicon nitride and silicon oxynitride.

8. (currently amended) The method of claim 1 wherein said
fluorine[-] containing etchant-gas based etching chemistry
comprises a gas selected from the group consisting of a
fluorocarbon gas, fluoronitride a fluorine and nitrogen

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containing gas, and fluorosulfur a fluorine and sulfur containing gas.

9. (currently amended) A method for forming a patterned silicon-containing layer gate electrode to reduce or prevent necking at an upper portion of the gate electrode, comprising the steps of:

providing a substrate;

forming a gate oxide layer on the substrate;

providing a polysilicon layer selected from the group consisting of polysilicon and amorphous silicon on said substrate gate oxide layer;

providing a hard mask layer on said polysilicon layer;

patternning and etching said hard mask layer;

subjecting said polysilicon layer to a partial first etch step using a fluorine[-]containing etchant gas based etching chemistry to etch through a first thickness portion of said silicon layer without exposing the gate oxide layer, said fluorine based etching chemistry comprising a fluorine containing etchant gas selected from the group consisting of a fluorocarbon, a fluorine and nitrogen containing gas, and a fluorine and sulfur containing gas; and

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then subjecting said polysilicon layer to a completed [-]
]] a second etch step to etch through a remaining thickness
portion of said silicon layer to expose said gate oxide layer
using an etchant gas devoid of fluorine.

10. cancelled

11. (currently amended) The method of claim 9 wherein said etchant gas devoid of fluorine comprises chlorine, oxygen, helium and bromine.

12. (currently amended) The method of claim 9 wherein said polysilicon layer comprises pre-doped polysilicon.

13. (currently amended) The method of claim 9 wherein said polysilicon layer comprises amorphous silicon.

14. (currently amended) The method of claim 9 wherein said partial[[[-]]] first etch step comprises the following process parameters: a chamber pressure of from about 5 mTorr to about 80 mTorr; a source radio frequency power of from about 100 watts to about 1500 watts at a source radio frequency of 13.56 MHz; and a bias power of from about 100 watts to about 1500 watts.

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15. (currently amended) A method for forming a patterned silicon-containing layer gate electrode to reduce or prevent necking at an upper portion of the gate electrode, comprising the steps of:

providing a substrate comprising an uppermost gate oxide layer;

providing a polysilicon layer on said substrate;

providing a hard mask layer on said polysilicon layer;

providing a bottom anti-reflective coating layer on said hard mask layer;

providing a photoresist layer on said bottom anti-reflective coating layer;

patterning and etching said hard mask layer;

stripping said bottom anti-reflective coating layer and said photoresist layer from said hard mask layer; and

etching said polysilicon layer according to said hard mask layer in a first etch step without exposing said gate oxide layer using a fluorine[-] containing etchant gas based etching chemistry primarily consisting of a fluorine-containing etchant gas;

then etching said silicon layer in a second etch step to expose said gate oxide layer using a chlorine and bromine based etching chemistry to form a gate electrode.

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16. (currently amended) The method of claim 15 wherein said fluorine-containing etchant gas comprises a gas selected from the group consisting of a fluorocarbon gas, fluoronitride a fluorine and nitrogen containing gas, and fluorosulfur a fluorine and sulfur containing gas.

17. cancelled

18. cancelled

19. (currently amended) The method of claim 15 wherein said polysilicon layer comprises pre-doped polysilicon.

20. (currently amended) The method of claim 15 wherein said polysilicon layer comprises amorphous silicon.

21. (currently amended) The method of claim 1 wherein said polysilicon layer comprises [(a)] pre-doped polysilicon having a [(D)] dopant gradient.

22. (currently amended) The method of claim 9 wherein said polysilicon layer comprises pre-doped polysilicon having a [(D)] dopant gradient of high [(D)] dopant concentration in a top layer portion to a low [(D)] dopant concentration in a bottom layer portion of said polysilicon layer.

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23. (new) The method of claim 15 wherein said silicon layer comprises pre-doped polysilicon having a dopant gradient of high dopant concentration in a top layer portion to a low dopant concentration in a bottom layer portion of said polysilicon layer.

24. (new) The method of claim 1 wherein said silicon layer comprises pre-doped polysilicon having a dopant gradient of high dopant concentration in a top layer portion to a low dopant concentration in a bottom layer portion of said polysilicon layer.

25. (new) The method of claim 1 wherein said etchant gas devoid of fluorine comprises chlorine and bromine.

26. (new) The method of claim 1 wherein said fluorine based etching chemistry consists primarily of a fluorine-containing etchant gas.

27. (new) The method of claim 9 wherein said fluorine based etching chemistry consists primarily of a fluorine-containing etchant gas.